New Quassinoid Glucosides, Picrasinoside-A, -B, -C, -D, -E, -F, and -G and New Hemiacetals, Picrasinol-A and -B, from the Stem Bark of *Picrasma ailanthoides* PLANCHON[1)]

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New quassinoid glucosides, picrasinoside-A, -B, -C, -D, -E, -F, and -G and new quassinoid hemiacetals, picrasinol-A and -B, were isolated from the stem bark of *Picrasma ailanthoides* PLANCHON, and their structures were established by spectral analyses and chemical transformations.

Since bruceantin[2)] isolated from the Ethiopian *Brucea antidysenterica* has been shown to have antitumor activity,[3)] quassinoids[4,5)] have been noted for their biological activity.[6–8)] Quassinoids of the Japanese *Picrasma ailanthoides* PLANCHON (=*P. quassioides BENNETT*) have been investigated in detail by Murae *et al.*[9–14)] and Hikino *et al.*[15)] and more than twenty quassinoides have been obtained. However, very few reports for quassinoid glycosides[16–18)] have been found. We were interested in quassinoid glycosides of *P. ailanthoides* and tried to isolate the glycosides from the stem bark of the plant. We wish to report on the isolation and structures of seven new quassinoid glycosides and two new quassinoid hemiacetals.

The half-dried stem bark of *P. ailanthoides* was continuously extracted with methanol and the extract was defatted by partition between hexane and water containing small amounts of methanol. The aqueous layer was further extracted with chloroform. The organic layer was evaporated to give a residue which was subjected to separation by silica-gel column chromatography, thin-layer chromatography (TLC), and high-performance liquid chromatography (HPLC) to afford seven new quassinoid glucosides, picrasinoside-A (**1**, 0.0024%), -B [**5**, 0.0042%), -C (**6**, 0.0062%), -D (**7**, 0.0011%), -E (**8**, 0.0022%), -F (**9**, 0.0006%), and -G (**10**, 0.0009%) and two new quassinoid hemiacetals, picrasinol-A (**11**, 0.032%) and -B (**12**, 0.029%), together with a known neoquassin (0.026%).[10)] Structures of new compounds and their derivatives are shown in Fig. 1. Physical (mp and specific rotation) and spectral (UV and IR) data of new compounds are shown in Table 1 and the ^{1}H NMR spectra of these compounds and their derivatives are shown in Table 2.

Picrasinoside-A (**1**) takes the form of colorless plates and has a bitter taste. A spectral examination (Tables 1 and 2) showed the presence of hydroxyl (IR 3350 cm^{-1}), lactone (IR 1735 (sh) and 1230 cm^{-1}), ketone (IR 1720 cm^{-1}), α,β-unsaturated ketone (IR 1680 cm^{-1}; UV 252 nm), a proton at the lactone terminus (^{1}H

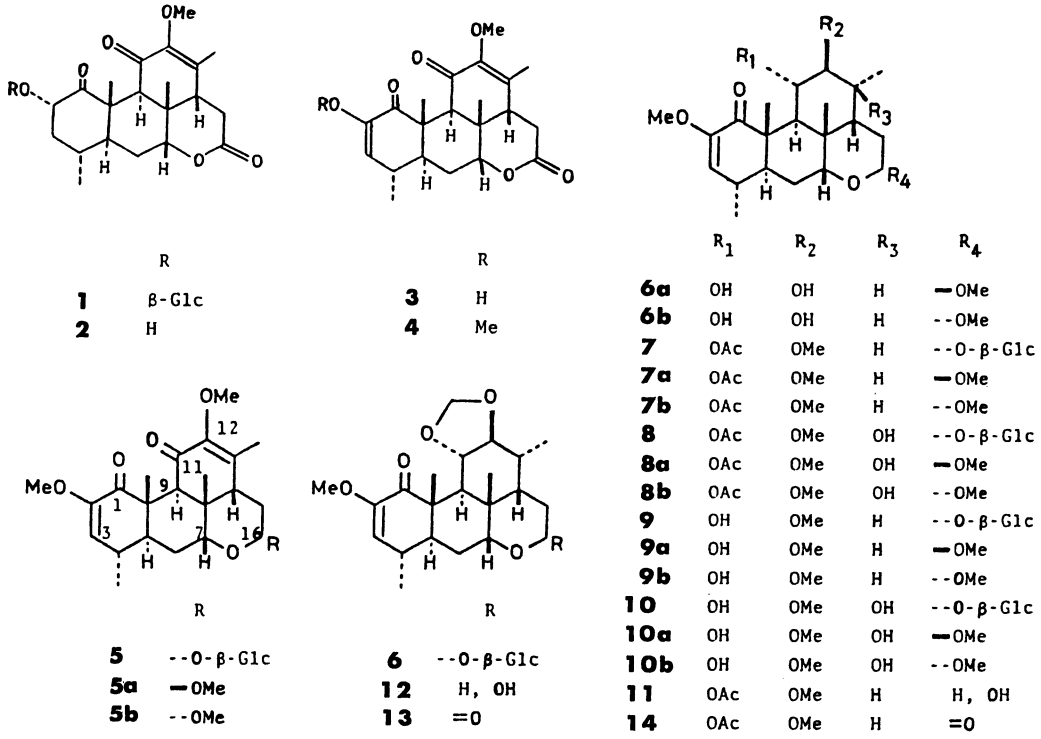

Fig. 1. Structures of quassinoid glucosides, hemiacetals, and their derivatives.

Table 1. Physical and spectral data of quassinoid glucosides and hemiacetals

Compound	Mp(°C)	$[\alpha]_D$	$\lambda_{max}^{EtOH}(\varepsilon)$	ν_{max}/cm^{-1}
1	167.5—168.5	−32.5°	252 (8000)	3350, 1735, 1720, 1680, 1640, 1230, 1080, 1030
5	153—153.5	−15.1°	255 (11300)	3400, 1690, 1675(sh), 1640, 1085, 1040
6	163.5—164	−41.1°	261 (4400)	3400, 2740(sh), 1700, 1640, 1090, 1035
7	144—144.5	+3.3°	262 (3800)	3400, 1735, 1705, 1640, 1245, 1075, 1030
8	163—164	−14.7°	262 (3500)	3400, 1730, 1705, 1640, 1250, 1070, 1030
9	153—154	−8.2°	271 (4400)	3400, 1670, 1640, 1070, 1040
10	162—163	+24.2°	271 (6100)	3400, 1670, 1645, 1070, 1040
11	122—124	+49.6°	261 (3800)	3450, 1730, 1710, 1700, 1640, 1245
12	205—206	+12.1°	262 (4600)	3450, 2740, 1710, 1700, 1640

Table 2. ^1H NMR Spectra of quassinoid glucosides, hemiacetals, and their derivatives

Compound	t-Me	s-Me	-OMe	H-9	H-11	H-12	H-7	H-3	H-16	H-1′	Others
1	1.15s 1.42s 1.89s	0.91d (J=5)	3.61s	3.24s	—	—	4.27m	a)	a)	4.6m	
5	1.06s 1.52s 1.85s	1.09d (*J*=6)	3.56s 3.63s	3.18s	—	—	3.82m	5.31d (*J*=2)	4.83dd (*J*=2.5,6)	4.65d (*J*=7)	
5a	1.06s 1.52s 1.82s	1.11d (*J*=6)	3.57s 3.62s	3.18s	—	—	a)	5.27d (*J*=2.5)	4.78dd (*J*=3,3)	—	16β-OMe 3.35s
5b	1.04s 1.53s 1.83s	1.11d (*J*=7)	3.56s 3.63s	3.18s	—	—	a)	5.27d (*J*=2.5)	4.36dd (*J*=2.5,9)	—	16α-OMe 3.46s
6	1.15s 1.38s	1.10d (*J*=6.5) 1.12d (*J*=6)	3.54s	2.74d (*J*=11)	a)	a)	3.82m	5.24d (*J*=2)	4.73dd (2.5,5)	4.61d (*J*=7)	-O-CH$_2$-O- 4.96d(*J*=1) 5.13d(*J*=1)
12	1.14s 1.20s[b] 1.38s	1.07d (*J*=6.5) 1.04d(*J*=6.5)[b] 1.08d (*J*=7)	3.55s	2.76d (*J*=11) 2.51d(*J*=11)[b]	a)	a)	3.94m	5.21d (*J*=2.5)	4.69m 5.35m[b]	—	-O-CH$_2$-O- 4.97d(*J*=1) 5.15d(*J*=1)
6a	1.14s 1.40s	1.03d (*J*=7) 1.12d (*J*=7)	3.59s	2.51d (*J*=11)	a)	a)	a)	5.44d (*J*=2.5)	4.73m	—	16β-OMe 3.31s
6d	1.12s 1.40s	1.02d (*J*=7) 1.12d (*J*=7)	3.58s	2.51d (*J*=11)	a)	a)	a)	5.43d (*J*=2.5)	4.28dd (*J*=2,8)	—	16α-OMe 3.44s
7	1.15s 1.23s	0.99d (*J*=7) 1.06d (*J*=6.5)	3.39s 3.54s	2.86d (*J*=11)	5.17dd (*J*=9,11)	3.18dd (*J*=9,11)	3.85m	5.12d (*J*=2.5)	4.73bm (12)[c]	4.60d (*J*=7)	-OAc 1.94s
11	1.14s 1.18s[b] 1.25s	0.99d (*J*=6) 1.06d (*J*=7)	3.40s 3.54s	2.87d (*J*=11)	5.18dd (*J*=9,11)	3.14dd (*J*=9,11)	3.86m	5.10d (*J*=2.5)	4.70bm 5.34m[b]	—	-OAc 1.94s
8	1.21s 1.23s 1.39s	1.07d (*J*=6.5)	3.50s 3.56s	2.83d (*J*=11)	5.49dd (*J*=9,11)	3.36d (*J*=9)	3.87m	5.13d (*J*=2.5)	4.72bm (12)[c]	4.60d (*J*=8)	-OAc 1.96s
9	1.10s 1.42s	0.98d (*J*=7) 1.10d (*J*=6)	3.57s 3.58s	2.46d (*J*=11)	a)	a)	3.83m	5.43d (*J*=2.5)	4.71dd (*J*=2.5,6)	4.60d (*J*=7)	
10	1.19s 1.34s 1.44s	1.11d (*J*=7)	3.58s 3.67s	2.48d (*J*=11)	a)	2.98d (*J*=9)	3.83m	5.42d (*J*=2)	4.71bm (12)[c]	4.60d (*J*=7)	

a) Not assigned. b) Signals due to the other isomer at C-16. c) Half width in Hz.

NMR δ 4.27, m), an anomeric proton at the glucose moiety (^1H NMR δ 4.6, m) two tertiary methyl groups, a secondary methyl group, and a methoxyl group (^1H NMR δ 1.15, s, δ 1.15, s, δ 0.91, d, and δ 3.61, s,

respectively). The FD mass spectrum of **1** ($C_{27}H_{38}O_{11}$, MW 538) showed a molecular ion at *m/z* 538 and a pseudo molecular ion at *m/z* 551 (M^++Na).

An acid hydrolysis of picrasinoside-A (**1**) gave picrasin B[15] (**2**,=nigakilactone I)[10] which was further converted to dehydropicrasin B (**3**)[15] and finally to quassin (**4**).[9] The sugar moiety was identified as D-glucose by a gas-chromatographic comparison of trimethylsilyl derivatives of the hydrolyzed product and authentic D-glucose. An enzyme hydrolysis of picrasinoside-A (**1**) using β-glucosidase also gave picrasin B (**2**) and D-glucose. From the above results, picrasinoside-A (**1**) was confirmed as 2α-*O*-β-glucopyranosylpicrasin B (=2α-*O*-β-glucopyranosylnigakilactone I).

Picrasinoside-B (**5**) takes also the form of colorless plates and has a bitter taste. The spectral data (Tables 1 and 2) showed the presence of hydroxyl (IR 3400 cm^{-1}), α,β-unsaturated ketones (IR 1690 and 1675 (sh) cm^{-1}; UV 255 nm), a proton at the hemiacetal terminus (^1H NMR δ 3.82, m), a proton at C-3 (^1H NMR δ 5.31, d), a proton at C-16 (^1H NMR δ 4.83, dd), an anomeric proton at the glucose moiety (^1H NMR δ 4.65, d), three tertiary methyl groups, a secondary methyl group, and two methoxyl groups (^1H NMR δ 1.06, s, δ 1.52, s, δ 1.85, s, δ 1.09, d, δ 3.56, s, and δ 3.63, s, respectively). The FAB mass spectrum of picrasinoside-B (**5**, $C_{18}H_{40}O_{11}$, MW 522) showed the pseudo molecular ion to be *m/z* 553 (M^++1).

An acid hydrolysis of picrasinoside-B (**5**) in methanol gave two compounds (**5a** and **5b**) and each compound (11:5) was isolated as a colorless amorphous powder by HPLC. Both compounds were characterized by the molecular formula $C_{23}H_{32}O_6$ (mass), a disappearance of the hydroxyl group (IR), and an appearance of a methoxyl group to the original compound (^1H NMR). These facts suggest that they are methanolysis products of picrasinoside-B (**5**). They were also obtained by heating neoquassin and methanol using sulfuric acid as a catalyst. ^1H NMR spectra reveal that the compound **5a** is 16β-*O*-methylneoquassin from an 16α-proton signal at δ 4.78 (dd, *J*=3,3) and the compound **5b** is 16α-*O*-methylneoquassin from an 16β-proton signal at δ 4.36 (dd, *J*=2.5, 9). Thus, picrasinoside-B (**5**) is confirmed as 16α-*O*-β-glucopyranosylneoquassin from an 16β-proton signal at δ 4.83 (dd, *J*=2.5, 6) and an 1′α-proton signal at δ 4.65 (d, *J*=7).

Picrasinol-B (**12**) forms as colorless needles and has a bitter taste. The spectral data showed the presence of hydroxyl (IR 3450 cm^{-1}), methylenedioxy (IR 2740 cm^{-1}; ^1H NMR δ 4.97, d and δ 5.15, d), α,β-unsaturated ketone IR 1710 cm^{-1}; UV 262 nm), a proton at the hemiacetal terminus (^1H NMR δ 3.94, m), a proton at C-3 (^1H NMR δ 5.21, d), a proton at C-16 (^1H NMR δ 4.69, bm and/or δ 5.35, m, tautomers), two tertiary methyl groups, two secondary methyl groups, and a methoxyl group (^1H NMR δ 1.14, s and/or δ 1.20, s, δ 1.38, s, δ 1.07, d and/or δ 1.04, d, δ 1.08, d and δ 3.55, s, respectively). The high-mass spectrum of **12** (M^+, *m/z* 392.21926) revealed the molecular to be $C_{22}H_{32}O_6$.

Picrasinol-B showed two peaks in HPLC and GC and it was positive against the silver mirror test. When each compound was isolated using a preparative HPLC and subjected to analytical HPLC, each sample showed the same chromatogram as the original one. This phenomenon shows that they are tautomers of hemiacetal. The reducing power of this substance depends upon the aldehyde as an intermediate. A Jones oxidation[19] of picrasinol-B (**12**) gave picrasin D (**13**)[15] as a colorless amorphous powder. From these results, the structure of picrasinol-B (**12**) was confirmed as shown in Fig. 1.

Picrasinoside-C (6) takes the form of colorless plates and exhibits a bitter taste. The spectral data indicated the presence of hydroxyl (IR 3400 cm^{-1}), a methylenedioxy group (IR 2740 (sh) cm^{-1}; ^1H NMR δ 4.96, d, and δ 5.13, d), an α,β-unsaturated ketone (IR 1700 cm^{-1}; UV 261 nm), a proton at the hemiacetal terminus (^1H NMR δ 3.82, m) a proton at C-3 (^1H NMR δ 5.24, d, a proton at C-16 (^1H NMR δ 4.73, dd), an anomeric proton at the glucose moiety (^1H NMR δ 4.61, d), two tertiary methyl groups, two secondary methyl groups, and a methoxyl group (^1H NMR δ 1.15, s, δ 1.38, s, δ 1.10, d, δ 1.12, d, δ 3.54, s, respectively). The FAB mass showed pseudo molecular ion at *m/z* 555 (M^++1).

An acid hydrolysis of picrasinoside-C (**6**) also gave two compounds (**6a** and **6b**); each compound (74:26) was isolated as a colorless amorphous powder by preparative HPLC. Both compounds were characterized by the molecular formula $C_{22}H_{34}O_6$ (mass), a disappearance of a methylenedioxy group (IR and ^1H NMR), and the appearance of a methoxyl group (^1H NMR). The disappearance of the methylenedioxy group depends upon the heating in sulfuric acid. Since picrasinol-B (**12**) and picrasin D (**13**)[15] also lost their methylenedioxy groups upon heating at 60 °C in dilute sulfuric acid to give nigakihemiacetal C[10] and nigakilactone A,[9] respectively. Hydrolyzed products (**6a** and **6b**) were obtained by heating picrasin B (**12**) in a mixture of dilute sulfuric acid and methanol at 60 °C. From these chemical transformations and chemical shifts at C-16, the hydrolyzed products (**6a** and **6b**) were revealed to be 16β-*O*-methylnigakihemiacetal C (=nigakihemiacetal F)[14] and 16α-*O*-methylnigakihemiacetal C, respectively. The sugar moiety was identified as D-glucose by a gas-chromatographic comparison of the trimethylsilyl derivative of the hydrolyzed product and authentic D-glucose. Thus, picrasinoside-C (**6**) was confirmed as 16α-*O*-β-glucopyranosylpicrasinol-B from an 16β-proton signal at δ 4.73 (dd, *J*=2.5, 5), an 1′α-proton signal at δ 4.61 (d, *J*=7), and the above results. Furthermore, an acid hydrolysis of picrasinoside-C in ethanol and 1-butanol gave, respectively, ethanolysis products and butanolysis products. The ^{13}C NMR spectrum of picrasinoside-C[20] also supports the structure as shown in Fig. 1.

Picrasinol-A (**11**) is a colorless amorphous powder and has a bitter taste. The spectral data showed the presence of hydroxyl (IR 3450 cm^{-1}), acetoxyl (IR 1730 and 1245 cm^{-1}; ^1H NMR δ 1.94, s), α,β-unsaturated ketone IR 1710 cm^{-1}; UV 261 nm), a proton at the hemiacetal terminus (^1H NMR δ 3.86, m), a proton at C-3 (^1H NMR δ 5.10, d), a proton at tertiary methyl groups, two secondary methyl groups, and two methoxyl groups (^1H NMR δ 1.14, s and/or δ 1.18, s, δ 1.21, s, δ 0.99, d, δ 1.06, d, δ 3.40, s, and δ 3.54, s, respectively. Picrasinol-A (**11**) showed the same behavior in the HPLC and silver-mirror test as those of picrasinol-B. A Jones oxidation[19] of picrasinol-A (**11**) gave nigakilactone-C (**14**)[9] as a colorless amorphous powder. From the above results, the structure of picrasinol-A (**11**) was confirmed as shown in Fig. 1.

Picrasinoside-D (**7**) takes the form of colorless plates and exhibits bitter taste. The spectral data reveal the presence of hydroxyl (IR 3400 cm^{-1}), acetoxyl (IR 1735 and 1245 cm^{-1}; ^1H NMR δ 1.94, s), α,β-unsaturated ketone (IR 1705 cm^{-1}; UV 262 nm), a proton at the hemiacetal terminus (^1H NMR δ 3.85, m), a proton at C-3 (^1H NMR δ 5.12, d), a proton at C-16 (^1H NMR δ 4.73, bm), an anomeric proton at the glucose moiety (^1H NMR δ 4.60, d), two tertiary methyl groups, two secondary methyl groups, and two methoxyl groups (^1H NMR δ 1.15, s, δ 1.23, s, δ 0.99, d, δ 1.06, d, δ 3.39, s, and δ 3.54, s, respectively). The spectral data was similar to that of picrasinol-A (**11**). The FD mass spectrum of picrasinoside-D (**7**) showed the molecular ion ($C_{30}H_{46}O_{12}$) at m/z 598.

An acid hydrolysis of picrasinoside-D (**7**) gave two compounds (**7a** and **7b**); each compound (8:3) was isolated as a colorless amorphous powder using a preparative HPLC. The two compounds (**7a** and **7b**) were also obtained by heating a mixture of picrasinol-A (**11**) and methanol using sulfuric acid as a catalyst. Therefore, they are considered as acetals of picrasinol-A (**11**). 16β-*O*-methyl derivatives (**5a** and **6a**) showed larger molecular ion intensity (90 and 54%) than that (21% and 26%) of 16α-isomers (**5a** and **6b**). Therefore, the products **7a** and **7b** should be 16β-*O*-methyl picrasinol-A (M^+, 1.9%) and 16α-*O*-methylpicrasinol-A (M^+, 0.8%), respectively. The sugar moiety was identified as D-glucose by the same method mentioned before. Picrasinoside-D (**7**) is thus confirmed as 16α-*O*-β-glucopyranosylpicrasinol-A from the above results and ^1H NMR signals of 16β-proton at δ 4.73 (half width 12 Hz) and 1'α-proton at δ 4.60 (d, J=7).

Picrasinoside-E (**8**) takes the form of colorless plates and has a bitter taste. The spectral data showed the presence of hydroxyl (IR 3400 cm^{-1}), acetoxyl (IR 1730 and 1250 cm^{-1}; ^1H NMR δ 1.96, s), an α,β-unsaturated ketone (IR 1705 cm^{-1}; UV 262 nm), a proton at the hemiacetal terminus (^1H NMR δ 3.87, m), a proton at C-3 (^1H NMR δ 5.13, d), a proton at C-16 (^1H NMR δ 4.72, bm), an anomeric proton at the glucose moiety (^1H NMR δ 4.60, d), three tertiary methyl groups, a secondary methyl group, and two methoxyl groups (^1H NMR δ 1.21, s, δ 1.23, s, δ 1.39, s, δ 1.07, d, δ 3.50, s, and δ 3.56, s, respectively). The spectral data were similar to that of nigakihemiacetal D.[12] The FD mass spectrum of picrasinoside-E (**8**, $C_{30}H_{46}O_{13}$, MW 614) showed the molecular ion at m/z 614.

An acid hydrolysis of picrasinoside-E (**8**) also gave two compounds (**8a** and **8b**); each compound (2:1) was isolated as a colorless amorphous powder using a preparative HPLC. Their mass spectra suggested that **8a** and **8b** are 16β-*O*-methylnigakihemiacetal D (M^+, 3.2%) and 16α-*O*-methylnigakihemiacetal D (M^+, 2.9%), respectively. **8a** and **8b** were converted into nigakihemiacetal D[12] by acid hydrolysis, which was identified by comparing its IR and MS spectra with those of the authentic one. The sugar moiety was identified as D-glucose in the same manner as described before. Picrasinoside-E (**8**) is, thus, confirmed as 16α-*O*-β-glucopyranosylnigakihemiacetal D from the above results and ^1H NMR signals of an 16β-proton at δ 4.72 (half width 12 Hz) and an 1'α-proton at δ 4.60 (d, J=8).

Picrasinoside-F (**9**) is also in the form of colorless plates and has a bitter taste. The spectral data showed the presence of hydroxyl (IR 3400 cm^{-1}), an α,β-unsaturated ketone (IR 1670 cm^{-1}; UV 271 nm), a proton at the hemiacetal terminus (^1H NMR δ 3.83, m), a proton at C-3 (^1H NMR δ 5.43, d), a proton at C-16 (^1H NMR δ 4.71, dd), an anomeric proton at the glucose moiety (^1H NMR δ 4.60, d), two tertiary methyl groups, two secondary methyl groups, and two methoxyl groups (^1H NMR δ 1.10, s, δ 1.42, s, δ 0.98, d, δ 1.10, d, δ 3.57, s, and δ 3.58, s, respectively). The FD mass spectrum of picrasinoside-F (**9**, $C_{28}H_{44}O_{11}$, MW 556) showed the molecular ion at m/z 556.

An acid hydrolysis of picrasinoside-F (**9**) gave two compounds (**9a** and **9b**); each one (7:3) was isolated as a colorless amorphous powder using a preparative HPLC. They were also obtained by deacetylation (alkaline hydrolysis) from **7a** and **7b**. Therefore, **9a** and **9b** should be 11-deacetoxyl-16β-*O*-methylpicrasinol-A and 11-deacetoxyl-16α-*O*-methylpicrasinol-A, respectively. The sugar moiety was identified as D-glucose in the same manner as described above. Thus, picrasinoside-F (**9**) is confirmed as 11-deacetyl-16α-*O*-β-glucopyranosylpicrasinol-A from the above results and ^1H NMR signals of an 16β-proton at δ 4.71 (dd, J=2.5, 6) and an 1'α-proton at δ 4.60 (d, J=7).

Picrasinoside-G (**10**) also takes the form of colorless plates and has a bitter taste. The spectral data showed the presence of hydroxyl (IR 3400 cm^{-1}), an α,β-unsaturated ketone (IR 1670 cm^{-1}; UV 271 nm), a proton at the hemiacetal terminus (^1H NMR δ 3.83, m), a proton at C-3 (^1H NMR δ 5.42, d), a proton at C-16 (^1H NMR δ 4.71, bm), an anomeric proton at the glucose moiety (^1H NMR δ 4.60, d), three tertiary methyl groups, a secondary methyl group, and two methoxyl groups (^1H NMR δ 1.19, s, δ 1.34, s, δ 1.44, s, δ 1.11, d,

δ 3.58, s, and δ 3.67, s, respectively). The spectral data was similar to that of nigakihemiacetal A.[10] The FD mass spectrum of picrasinoside-G (**10**, $C_{28}H_{44}O_{12}$, MW 572) showed the pseudo molecular ion at *m/z* 573 (M^++1).

An acid hydrolysis of picrasinoside-G (**10**) also gave two compounds (**10a** and **10b**) and each one (7:3) was isolated as a colorless amorphous powder using a preparative HPLC. They were also obtained by the deacetylation (alkaline hydrolysis) of **8a** and **8b**. Therefore, **10a** and **10b** were confirmed as 16β-*O*-methylnigakihemiacetal A and 16α-*O*-methylnigakihemiacetal A, respectively. This fact was supported by their mass spectra. The sugar moiety was identified as D-glucose by the same method as mentioned above. Thus, picrasinoside-G (**10**) is confirmed as 16α-*O*-β-glucopyranosylnigakihemiacetal A from the above results and the ^{1}H NMR signals of an 16β-proton at δ 4.71 (half width 12 Hz) and an 1′α-proton at δ 4.60 (d, *J*=7).

Thus, seven quassinoid glucosides, picrasinoside-A (**1**), -B (**5**), -C (**6**), -D (**7**), -E (**8**), -F (**9**), and -G (**10**) and two quassinoid hemiacetals, picrasinol-A (**11**) and -B (**12**) were newly isolated from the stem bark of *P. ailanthoides*, although Murae *et al.*[9-14] and Hikino *et al.*[15] had obtained eighteen quassinoids with a lactone moiety and six quassinoid hemiacetals from the stem of the plant. Among them, picrasinoside-A (**1**) and -B (**5**) were subjected to testing regarding the mean survival time (*T/C*%) in mice suffering from P 388 lymphocytic leukemia (test system: 3PS31); both compounds were inactive.[21] Cytotoxic and antileukemic activities in P 388 screen *in vitro* were also tested for picrasinoside-A (**1**), picrasin B (**2**), picrasinoside -B (**5**), and related compounds. The results will be reported elsewhere.[22]

Experimental

General Procedure. Melting points were determined on a MRK air-bath-type melting-point apparatus and were uncorrected. Specific rotations were obtained on a Yanagimoto OR-50 polarimeter (l=0.5 dm). Infrared (IR) and ultraviolet (UV) spectra were recorded, respectively, on a Hitachi 215 grating IR spectrometer and a Shimadzu 200-S UV spectrometer. Proton nuclear magnetic resonance (^{1}H NMR) spectra were determined on JEOL JNM-MH-60 II (60 MHz) and Hitachi R-22 (90 MHz) NMR spectrometers using tetramethylsilane as an internal standard in chloroform-*d* or pyridine-d_5. Chemical shifts and coupling constants were, respectively, shown in ppm and Hz. Mass spectra were determined on JEOL JMS-D100 (EI) and JEOL JMS-DX300 (EI and FD) instruments. Gas chromatography (GC) was performed on a Shimadzu GC-mini II gas chromatograph (2% OV-1). High-performance liquid chromatography (HPLC) was performed on a Waters ALC/GPC 206 liquid chromatograph using Radial PAK C_{18} and CN columns, and 441 UV and R401 RI detectors. Silica-gel (Merck, type 60), precoated silica-gel plates (Merck, 60 F-254, 0.25 mm), and silica gel (Merck, 60 HF-254+366) were used, respectively, for column chromatography, thin-layer chromatography (TLC), and the preparation of preparative TLC plates. The detection of components was accomplished either by the use of a UV lamp or by spraying 10% sulfuric acid solution, follwed by heating.

Plant Material and Extraction. Half-dried stem bark (3.1 kg) of *P. ailanthoides*, collected at Iwate prefecture in June of 1982, was extracted 3 times with methanol (30 l) at room temperature for 3 d. The methanol solutions were combined and the solvent was removed by evaporation until precipitates were found. The concentrated suspension was defatted with hexane (500 ml×5 times) and then extracted with chloroform (500 ml×5 times). The chloroform solutions were combined and concentrated to give a residue (40.5 g).

Separation. The residue (40.5 g) obtained by the chloroform extraction was subjected to column chromatographic separation (silica gel 1.7 kg), and eluted with chloroform–methanol (35:1, v/v, 17 l and then 8:1, v/v, 21 l); 27 fractions were collected. Each fraction was checked by TLC using two mixed solvents, ethyl acetate–ether (1:1, v/v) and chloroform–methanol–water (50:14:3, v/v, lower layer) to look for quassinoids and their glycosides which show UV absorption. As a result, fractions 19 (1.28 g) and 20 (1.14 g) were assumed to contain quassinoid glycosides, and fraction 7 (2.49 g) was considered to include their aglycons.

Isolation of Quassinoid Glycosides. Preparative TLC of fractions 19 and 20 using a mixed solvent of chloroform–methanol–water (50:14:3, v/v, lower layer) gave pale-yellow amorphous substances (715 and 642 mg, respectively), which showed strong UV absorption. The former (715 mg) showed three peaks with a shoulder in HPLC using Radial PAK C_{18} and a mixed solvent of water–methanol (3:2, v/v) and were subjected to preparative HPLC to afford picrasinoside-A (**1**, 74 mg), picrasinoside-G (**10**, 28 mg), picrasinoside-E (**8**, 68 mg), and picrasinoside-B (**5**, 111 mg), respectively. The latter (642 mg) showed four peaks with a shoulder in HPLC using Radial PAK C_{18} and a mixed solvent of water–methanol (11:9 v/v) and were subjected to preparative HPLC to give picrasinoside-F (**9**, 19 mg), picrasinoside-B (**5**, 19 mg), picrasinoside-D (**7**, 34 mg), and picrasinoside-C (**6**, 192 mg).

Acid Hydrolysis of Glycosides. Each glycoside (10—20 mg) was dissolved in methanol (4 ml) and then 1.5 M† sulfuric acid (2 ml) was added to the solution. The mixture was stirred at 60 °C (80 °C in case of picrasinoside-A) and the termination of hydrolysis was checked by TLC. After cooling, water (5 ml) was added to the reaction mixture, and the product (aglycon) was extracted with chloroform (5 ml×3 times). The extract was subjected to HPLC (radial PAK C_{18} or CN) to give pure aglycon. The water layer was neutralyzed with anion-exchange resins (Amberlite IRA-410), evaporated, and dried on P_2O_5 in a desiccator to give a residue (sugar). The residue was treated with 1-(trimethylsilyl)-imidazole at 90 °C for 1 h and then water was added to the reaction mixture to decompose the excess reagent. The reaction product was extracted with hexane (1 ml×3 times) and the hexane layer was washed with water (1 ml×3 times). The hexane solution was subjected to GC for an identification of the sugar moiety.

Enzyme Hydrolysis of Glycosides. Sixty mg of β-glucosidase (Boehringer Mannheim) was dissolved in a tris(hydroxymethyl)methanamine–hydrochloric acid buffer solution (20 mM, pH 3.4, 3 ml) under cooling with ice-water. Each glycoside (3 mg) was suspended in a sodium acetate buffer solution (0.1 M, pH 5.0, 2 ml) and then a enzyme

† 1 M=1 mol dm^{-3}.

solution (0.1 ml) was added to the suspension. The mixture was stirred in a thermostat (25 °C). The termination of hydrolysis was checked by TLC. Aglycon and sugar were identified using the method as described above.

Isolation of Quassinoid Hemiacetals. A preparative TLC of fraction 7 using an ethyl acetate–diethyl ether (1:1, v/v) gave a pale-yellow amorphous substance (788 mg) which showed strong UV absorption. The substance showed six peaks in HPLC using Radial PAK CN and a mixed solvent of hexane–ethyl acetate (4:1, v/v), and was subjected to preparative HPLC to afford picrasinol-A (**11**, 152 mg) (corresponding to the first and the second peaks), picrasinol-B (**12**, 137 mg) (corresponding to the third and the fifth peaks), and neoquassin (123 mg) (corresponding to the fourth and the sixth peaks).

Methylation of Quassinoid Hemiacetals. A 1.5 M sulfuric acid–methanol (1:2, v/v) solution of each hemiacetal was stirred at 60 °C for 5 h and the methylated products were extracted with chloroform. The chloroform layer was washed with water and then the two products, methoxy isomers at C-16, were obtained by preparative HPLC (Radial PAK CN and a mixed solvent of hexane–ethyl acetate).

Jones Oxidation. A Jones reagent[19] (0.3 ml) was diluted with acetone (3 ml). The diluted oxidant was added to an acetone solution (1 ml) of a sample under cooling with ice-water. After the addition, the reaction mixture was stirred for 5 h and then a small amount of ethanol was added to the mixture to decompose the excess oxidant. Water (10 ml) was added to the mixture and the product was extracted with chloroform and purified by preparative HPLC (Radial PAK C_{18} and a mixed solvent of water–methanol).

Acid Hydrolysis of Picrasinoside-A (1). Picrasinoside-A (1, 19 mg) and 1.5 M sulfuric acid–methanol (1:2, v/v, 6 ml) was stirred at 80 °C for 24 h. Chloroform extraction and HPLC purification (Radial PAK C_{18}, water–methanol, 9:11, v/v) of the hydrolyzed product gave picrasin B[15] (**2**, nigakilactone I,[10] 10 mg): a colorless amorphous powder; mp 227—230 °C (lit,[15] 255—257 °C); Mass *m/z* 376 (M^+, $C_{21}H_{28}O_6$); IR ($CHCl_3$) 3500, 1735, 1720, 1680, 1640, and 1230 cm^{-1}; ^1H NMR (60 MHz, $CDCl_3$) δ 0.90 (3H, d, J=6; $C_{(4)}$-CH_3), δ 1.16 and δ 1.42 (each 3H, s; $C_{(8)}$-CH_3 and $C_{(10)}$-CH_3), δ 1.89 (3H, s; $C_{(13)}$-CH_3), δ 3.27 (1H, s; $C_{(9)}$-H), δ 3.62 (3H, s; OCH_3), and δ 4.22 (1H, m; $C_{(7)}$-H). The water layer was treated to give a TMS derivative of the sugar. The derivative was analyzed by GC (OV-17, 2%, ID 2.6 mm, length 1.4 m, 140 °C, N_2 40 ml/min) which showed two peaks (t_R 12.5 and 21.2 min) and identified as the derivatives of α- and β-D-glucose by a comparison of the retention times with those of the authentic one.

Enzyme Hydrolysis of Picrasinoside-A (1). Picrasinoside-A (**1**, 3 mg) was suspended in a sodium acetate buffer solution (0.1 M, pH 5.0, 2 ml) and then the enzyme solution was added to the suspension. The mixture was stirred in a thermostat (25 °C) for 14 d. The aglycon was extracted with chloroform and identified as picrasin B by TLC, HPLC, GC, and GC-MS comparisons with those of the authentic one. Salts in the water layer were removed by treating with cation-exchange resins (Amberlite IR-120) and anion-exchange resins (Amberlite IRA-410). The water layer was dried and an obtained residue was converted into TMS derivatives of α- and β-D-glucose (identified by GC as described above).

Conversion of Picrasin B (2) into Quassin (4). Picrasin B (**2**, 9 mg) was oxidized with the Jones reagent as described above. A chloroform extraction of the reaction mixture and a purification by HPLC (C_{18}, water–methanol, 9:11, v/v) gave a colorless amorphous powder (**3**, dehydropicrasin B,[15] 5.8 mg): IR ($CHCl_3$) 3450, 1735, 1700, 1680, 1640, and 1230 cm^{-1}; Mass *m/z* 374 (M^+, $C_{21}H_{26}O_6$). Dehydropicrasin B (**3**, 5.3 mg) was further treated with a diazomethane–diethyl ether solution and the product was purified by HPLC (Radial PAK C_{18}, water–methanol, 9:11, v/v) to give colorless amorphous powder (**4**, quassin,[9] 1.7 mg): IR ($CHCl_3$) 1730, 1700, 1680, 1645, and 1640 cm^{-1}; Mass *m/z* 388 (M^+, $C_{22}H_{28}O_6$).

Conversion of Neoquassin into Quassin (4). Neoquassin (10 mg) isolated from *P. ailanthoides* was oxidized with the Jones reagent. A chloroform extraction of the reaction mixture and the purification by HPLC (Radial PAK C_{18}, water–methanol, 1:1, v/v) gave a colorless amorphous powder (**4**, quassin,[9] 8 mg): IR ($CHCl_3$) 1730, 1700, 1685, 1645, and 1640 cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.09 (3H, d, J=7; $C_{(4)}$-CH_3), δ 1.17 (3H, s; $C_{(8)}$-CH_3), δ 1.54 (3H, s; $C_{(10)}$-CH_3), δ 1.85 (3H, s; $C_{(13)}$-CH_3), δ 2.99 (1H, s; $C_{(9)}$-H), δ 3.57 and δ 3.65 (each 3H, s; OCH_3), δ 4.32 (1H, m; $C_{(7)}$-H), δ 5.33 (1H, d, J= 2; $C_{(3)}$-H); Mass *m/z* 388 (M^+, $C_{22}H_{28}O_6$).

Acid Hydrolysis of Picrasinoside-B (5). Picrasinoside-B (**2**, 35 mg) and 1.5 M sulfuric acid–methanol (1:2, v/v, 6 ml) were stirred at 60 °C for 5 h. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK CN, hexane–ethyl acetate, 4:1, v/v) to give two compounds as amorphous powders: 16β-*O*-methyl neoquassin (**5a**, 11 mg): IR ($CHCl_3$) 1690, 1680, and 1640 cm^{-1};. ^1H NMR (Table 2); Mass *m/z* (%) 404 (M^+, $C_{23}H_{32}O_6$; 90), 389(31), 372 (M^+—MeOH; 19), 357(13), 343(8), 329(29), 313(30), 302(33), 165(31), 154(7), 153(24), 152(100), 151(27), and 121(18) and 16α-*O*-methylneoquassin (**5b**, 5 mg): IR ($CHCl_3$) 1690, 1680, and 1640 cm^{-1}; ^1H NMR (Table 2); Mass *m/z* (%) 404 (M^+, $C_{23}H_{32}O_6$; 21), 389(4), 372 (M^+—MeOH; 79), 357(30), 343 (11), 329(42), 313(15), 302(100), 165(19), 154(4), 153(11), 152(39), 151(15), and 121(10). The water layer was treated in the same manner as described above and α- and β-D-glucose were identified.

Acid Hydrolysis of Picrasinoside-C (6). A mixture of picrasinoside-C (**6**, 20 mg) and 1.5 M sulfuric acid–methanol (1:2, v/v, 6 ml) was stirred at 60 °C for 5 h. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK CN, hexane–ethyl acetate, 7:3, v/v) to give two compounds as colorless amorphous powders: 16β-*O*-methylnigakihemiacetal C (=nigakihemiacetal F,[14] **6a**, 6.4 mg): IR ($CHCl_3$) 3420, 1680, and 1640 cm^{-1}; ^1H NMR (Table 2); Mass *m/z* (%) 394 (M^+, $C_{22}H_{34}O_6$; 54), 376 (M^+—H_2O; 86), 362 (M^+—MeOH; 18), 361(45), 344 (M^+—H_2O—MeOH; 36), 329(15), 316(48), 301(100), 257(46), 165(41), 154(27), 153(48), 152(52), 151(39), and 121(47) and 16α-*O*-methylnigakihemiacetal C (**6b**, 3.9 mg): IR ($CHCl_3$) 3410, 1680, and 1640 cm^{-1}; ^1H NMR (Table 2); Mass *m/z* (%) 394 (M^+, $C_{22}H_{34}O_6$; 26), 376 (M^+—H_2O; 11), 362 (M^+—MeOH; 35), 344 (M^+—H_2O—MeOH; 100), 329(39), 316(57), 301(83), 257(41), 165(45), 154(24), 153(46), 152(49), 151(25), and 121(46). The water layer was analyzed in the same manner as described above and α- and β-D-glucose were identified.

A mixture of picrasinoside-C (**6**, 5 mg) and 1.5 M sulfuric acid–ethanol (1:2, v/v, 3 ml) was stirred at 60 °C for 5 h. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK CN, hexane–ethyl acetate, 7:3, v/v) to give two compounds as colorless amorphous powders: 16β-*O*-ethyl nigakihemiacetal C (1.1 mg): Mass

m/z (%) 408 (M^+, $C_{23}H_{36}O_6$; 30), 390 (M^+-H_2O, 100), 375(69), 362(16), 344 ($M^+-H_2O-EtOH$; 47), 329(24), 316(25), 301(38), 251(30), 165(72), 154(52), 153(91), 152(100), 151(43), and 121(62) and 16α-*O*-ethylnigakihemiacetal C (0.5 mg): Mass *m/z* (%) 408 (M^+, $C_{23}H_{36}O_6$; 5), 390 (M^+-H_2O; 6), 375(4), 362(37), 344 ($M^+-H_2O-EtOH$; 100), 329(46), 316(30), 301(30), 251 (42), 165(49), 154(68), 152(63), 151(30), and 121(42).

A mixture of picrasinoside-C (**6**, 10 mg) and 1.5 M sulfuric acid-1-butanol (1:6, v/v, 3.5 ml) was stirred at 60°C for 5 h. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK CN, hexane–ethyl acetate, 7:3, v/v) to give two compounds as colorless amorphous powders: 16β-*O*-butylnigakihemiacetal C (2.5 mg): Mass *m/z* (%) 436 (M^+, $C_{25}H_{40}O_6$; 20), 418 (M^+-H_2O; 84), 403(61), 363(48), 344 ($M^+-H_2O-BuOH$; 57), 329(26), 316(39), 301(48), 251(32), 165(73), 154(61), 153(100), 152(98), 151(47), and 121(62) and 16α-*O*-butylnigakihemiacetal C (1.8 mg): Mass *m/z* (%) 436 (M^+, $C_{25}H_{40}O_6$; 6), 418 (M^+-H_2O; 6), 403(5), 362(44), 344 ($M^+-H_2O-BuOH$; 100), 329(48), 316(43), 301(43), 251(55), 165(69), 154(44), 153(84), 152 (78), 151(35), and 121(57).

*Conversion of Picrasinol-B (**12**) into Picrasin D.* Picrasinol-B (**12**, 20 mg) was oxidized with the Jones reagent in the same manner as described above. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK CN, water–methanol, 1:1, v/v) to give colorless amorphous powders: (**13**, picrasin D,[15] 13 mg): IR ($CHCl_3$) 2740, 1725, 1705, 1640, and 1240 cm^{-1}; UV (EtOH) 262 nm (ε 3300); ^1H NMR (60 MHz, $CDCl_3$) δ 1.10 (6H, d, *J*= 7; $C_{(4)}$-CH_3 and $C_{(13)}$-CH_3), δ 1.27 and δ 1.42 (each 3H, s; $C_{(8)}$-CH_3 and $C_{(10)}$-CH_3), δ 3.57 (3H, s; OCH_3), δ 4.23 (1H, m; $C_{(7)}$-H), δ 5.04 and δ 5.20 (each 1H, d, *J*=1; -O-CH_2-O-), δ 5.27 (1H, d, *J*=2; $C_{(3)}$-H; Mass *m/z* 390 (M^+, $C_{22}H_{30}O_6$).

*Conversion of Picrasinol-B (**12**) into 16β-O-Methylnigakihemiacetal C (=nigakihemiacetal F, **6a**) and 16α-O-Methylnigakihemiacetal C (**6b**).* A mixture of picrasinol-B (**12**, 15 mg) and 1.5 M sulfuric acid-methanol (1:2, v/v, 6 ml) was stirred at 60°C for 5 h. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK CN, hexane–ethyl acetate, 7:3, v/v) to give two compounds as colorless amorphous powders: 16β-*O*-methylnigakihemiacetal C (=nigakihemiacetal F,[14] **6a**) and 16α-*O*-methylnigakihemiacetal C (**6b**) whose spectral data coincided with those of the authentic one.

*Conversion of Picrasinoside-B (**12**) into Nigakihemiacetal C.* A mixture of picrasinol-B (**12**, 11 mg), acetone (0.1 ml), and 1.5 M sulfuric acid (2 ml) was stirred at 60°C for 3 h. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK C_{18}, water–methanol, 1:1, v/v) to give a colorless amorphous powder (nigakihemiacetal C,[10] 7 mg): IR ($CHCl_3$) 3400, 1680, and 1640 cm^{-1}; Mass *m/z* 380 (M^+, $C_{21}H_{32}O_6$).

*Conversion of Picrasin D (**13**) into Nigakilactone A.* A mixture of picrasin D (**13**, 7 mg), which was obtained by the Jones oxidation of picrasinol-B (**12**), and 1.5 M sulfuric acid (2 ml) was stirred at 60°C for 3 h. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK C_{18}, water–methanol, 1:1, v/v) to give a colorless amorphous powder (nigakilactone A,[9] 4 mg): IR ($CHCl_3$) 3400, 1680, and 1640 cm^{-1}; Mass *m/z* 378 (M^+, $C_{21}H_{30}O_6$).

*Acid Hydrolysis of Picrasinoside-D (**7**).* A mixture of picrasinoside-D (**7**, 9 mg) and 1.5 M sulfuric acid–methanol (1:2, v/v, 6 ml) was stirred at 60°C for 5 h. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK CN, hexane–ethyl acetate, 9:1, v/v) to give two compounds as colorless amorphous powders: 16β-*O*-methylpicrasinol-A (**7a**, 4 mg): IR ($CHCl_3$) 1730, 1705, 1640, and 1245 cm^{-1}; Mass *m/z* (%) 450 (M^+, $C_{25}H_{38}O_7$; 1.9), 418 (M^+-MeOH; 15), 390 (M^+-AcOH; 20), 375(100), 372(18), 358 ($M^+-AcOH-MeOH$; 27), 344(18), 343 (43), 315(18), 299(27), 165(24), 154(14), 153(19), 152(17), 151 (16), and 121(18) and 16α-*O*-methylpicrasinol-A (**7b**, 1.5 mg): IR ($CHCl_3$) 1730, 1705, 1640, and 1245 cm^{-1}; Mass *m/z* (%) 450 (M^+, $C_{25}H_{38}O_7$; 0.8), 418 (M^+-MeOH; 2.4), 390(2.6), 386(56), 375(30), 372(3), 358 ($M^+-AcOH-MeOH$; 80), 344(100), 343 (73), 315(29), 299(52), 165(16), 154(9), 153(16), 152(15), 151 (12), and 121(16). The water layer was analyzed in the same manner as described above and α- and β-D-glucose were identified.

*Methylation of Picrasinol-A (**11**).* A mixture of picrasinol-A (**11**, 13 mg) and 1.5 M sulfuric acid–methanol (1:2, v/v, 6 ml) was stirred at 60°C for 5 h. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK CN, hexane–ethyl acetate, 9:1, v/v) to give two compounds as colorless amorphous powders: 16β-*O*-methyl picrasinol-A (**7a**) and 16α-*O*-methylpicrasinol-A (**7b**). They were identified by spectral comparisons with those of the authentic one.

*Conversion of Picrasinol-A (**11**) into Nigakilactone C.*[9] Picrasinol-A (**11**, 14 mg) was oxidized with the Jones reagent in the same manner as described above. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK C_{18}, water–methanol, 1:1, v/v) to give a colorless amorphous powder (nigakilactone C,[9] 10 mg): mp 231—233°C (lit,[9] 252.5—253°C); IR ($CHCl_3$) 1735, 1730, 1705, 1640, and 1240 cm^{-1}; ^1H NMR (60 MHz, $CDCl_3$)δ 1.01 (3H, d, *J*=7; $C_{(13)}$-CH_3), δ 1.05 (3H, d, *J*=6; $C_{(4)}$-CH_3), δ 1.26 (6H, s, $C_{(8)}$-CH_3 and $C_{(10)}$-CH_3, δ 1.95 (3H, s, $OCOCH_3$), δ 3.41 and δ 3.54 (each 3H, s; OCH_3), δ 4.13 (1H, m; $C_{(7)}$-H, δ 5.10 (1H, d, *J*=2; $C_{(3)}$-H), and δ 5.18 (1H, dd, *J*=9, 11; $C_{(11)}$-H; Mass *m/z* 434 (M^+, $C_{24}H_{34}O_7$).

*Acid Hydrolysis of Picrasinoside-E (**8**).* A mixture of picrasinoside-E (**8**, 16 mg) and 1.5 M sulfuric acid–methanol (1:2, v/v, 6 ml) was stirred at 60°C for 5 h. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK CN, hexane–ethyl acetate, 4:1, v/v) to give two compounds as amorphous powders: 16β-*O*-methylnigakihemiacetal D (**8a**, 3.6 mg: IR ($CHCl_3$) 3450, 1730, 1705, 1640, and 1245 cm^{-1}; Mass *m/z* (%) 466 (M^+, $C_{25}H_{38}O_8$; 3.2), 434 (M^+-MeOH; 22), 406 (M^+-AcOH; 43), 391(42), 375(48), 374 ($M^+-AcOH-MeOH$; 38), 359(100), 331(46), 313(30), 299(35), 165(51), 154(24), 153(53), 152(51), 151(36), and 121(34) and 16α-*O*-methylnigakihemiacetal D (**8b**, 3.2 mg): IR ($CHCl_3$) 3450, 1730, 1705, 1640, and 1245 cm^{-1}; Mass *m/z* (%) 466 (M^+, $C_{25}H_{38}O_8$; 2.9), 434 (M^+-MeOH; 26), 406 (M^+-AcOH; 37), 391(30), 375(51), 374 ($M^+-AcOH-MeOH$; 77), 359(89), 331(100), 313(48), 299(47), 165(67), 154(32), 153(69), 152(66), 151(45), and 121(47).

*Conversion of Compounds **8a** and **8b** into Nigakihemiacetal D.* A mixture of **8a** and **8b** (4 mg) and 1.5 M sulfuric acid (2 ml) was stirred at 60°C for 3 h. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK CN, hexane–ethyl acetate, 4:1, v/v) to give a colorless amorphous powder (nigakihemiacetal D,[8] 2 mg): IR ($CHCl_3$) 3450, 1730, 1705, 1640, and 1245 cm^{-1}; Mass

m/z 452 (M^+, $C_{24}H_{36}O_8$).

Acid Hydrolysis of Picrasinoside-F (9). A mixture of picrasinoside-F (**9**, 4.2 mg) and 1.5 M sulfuric acid–methanol (1:2, v/v, 6 ml) was stirred at 60 °C for 5 h. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK CN, hexane–ethyl acetate, 4:1, v/v) to give two compounds as colorless amorphous powders: 11-deacetyl-16β-*O*-methylpicrasinol-A (**9a**, 1.1 mg): IR ($CHCl_3$) 3470, 1680, and 1645 cm^{-1}; Mass *m/z* (%) 408 (M^+, $C_{23}H_{36}O_6$; 7), 390 (M^+-H_2O; 2), 376 (M^+—MeOH; 78), 361(63), 358 (M^+-H_2O—MeOH; 13), 342 (100), 328(30), 313(27), 285(16), 217(51), 165(39), 154(25), 153(63), 152(47), 151(31), and 121(55) and 11-deacetyl-16α-*O*-methylpicrasinol-A (**9b**, 0.9 mg): IR ($CHCl_3$) 3470, 1680, and 1645 cm^{-1}; Mass *m/z* (%) 408 (M^+, $C_{23}H_{36}O_6$; 3), 390 (M^+-H_2O; 0.7), 376 (M^+—MeOH; 12), 361(5), 358 (M^+-H_2O—MeOH; 9), 344(52), 328 (100), 313(72), 285(25), 217(43), 165(24), 154(21), 153(41), 152 (32), 151(19), and 121(45). The water layer was analyzed in the same manner as described before and α- and β-D-glucose were identified.

Conversion of Compounds 7a and 7b into Compounds 9a and 9b. A mixture of **7a** and **7b** (*ca.* 4 mg) and 2% potassium hydroxide–ethanol (10 ml) was stirred at 80 °C for 2 h. The solvent was removed by distillation under reduced pressure from the reaction mixture to give a residue to which water (15 ml) was added and saturated with carbon dioxide gas for about 10 h. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK CN, hexane–ethyl acetate, 4:1, v/v) to give **9a** and **9b**. These were identified by spectral comparisons with authentic samples.

Acid Hydrolysis of Picrasinoside-G (10). A mixture of picrasinoside-G (**10**, 7 mg) and 1.5 M sulfuric acid–methanol (1:2, v/v, 6 ml) was stirred at 60 °C for 5 h. The reaction product was extracted with chloroform and subjected to preparative HPLC (Radial PAK CN, hexane–ethyl acetate, 17:3, v/v) to give two compounds as colorless amorphous powders: 16β-*O*-methylnigakihemiacetal A (**10a**, 3.1 mg): IR ($CHCl_3$) 3470, 1680, and 1645 cm^{-1}; Mass *m/z* (%) 424 (M^+, $C_{23}H_{36}O_7$; 9), 406 (M^+-H_2O; 45), 392 (M^+—MeOH; 22), 377 (32), 374 (M^+-H_2O—MeOH; 31), 359(17), 331(25), 304(37), 165(61), 154(50), 153(63), 152(77), 151(44), 127(100), and 121 (55) and 16α-*O*-methylnigakihemiacetal A (**10b**, 1.7 mg): IR ($CHCl_3$) 3470, 1680, and 1645 cm^{-1}; Mass *m/z* (%) 424 (M^+, $C_{23}H_{36}O_7$; 4.5), 406 (M^+-H_2O; 23), 392 (M^+—MeOH; 42), 377 (25), 374 (M^+-H_2O—MeOH; 71),359(25), 331(27), 304(26), 165(62), 154(41), 153(55), 152(74), 151(38), 127(100), and 121 (51). The water layer was analyzed in the same manner as described before and α- and β-D-glucose were identified.

Conversion of Compounds 8a and 8b into Compounds 10a and 10b. A mixture of **8a** and **8b** (*ca.* 2 mg) and 2% potassium hydroxide–ethanol (10 ml) was stirred at 80 °C for 2 h. The reaction mixture was treated in the same manner as described above and gave compounds **10a** and **10b**. These were identified by spectral comparisons with authentic samples.

Biological Activities of Picrasinoside-A (1) and -B (5). The mean survival time (*T/C*%) in mice suffering from P 388 lymphocytic leukemia (test system: 3PS31) was investigated by NCI (U.S.A.) for picrasinoside-A (**1**) and -B (**5**). The *T/C* values for picrasinoside-A (**1**) were 103, 107, and 103 at doses of 20.00, 10.00, and 5.00 mg/kg and those of picrasinoside-B (**5**) were 103, 94, and 96 at doses of 16.00, 8.00, and 4.00 mg/kg, respectively.[21]

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21) These data are the results of screening performed under the auspices of the Developmental Therapeutics Program, Division of Cancer Treatment, National Cancer Institute, Bethesda, Maryland.

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